



BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Biomedical Science Pearson BTEC International Level 3 Diploma in Environmental Science Pearson BTEC International Level 3 Extended Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Biomedical Science Pearson BTEC International Level 3 Extended Diploma in Environmental Science
Unit number and title	Unit 6: Principles and Applications of Chemistry II
Learning aim(s)	D: Understand the chemical behaviour, separation and applications of organic compounds
Assignment title	Behaviour, separation and applications of organic compounds
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a laboratory technician working in an analytical laboratory of a large drug company. Organic compounds are used in the preparation, analytical testing and use of many pharmaceutical drug compounds. They are also used in many procedures carried out in hospitals. Chromatography is used in many laboratories to monitor the progress of reactions, identify compounds and separate mixtures of similar compounds during their preparation. It is important that chemists, biochemists and biologists working in a variety of laboratories have a good knowledge of the behavior, separation and applications of common organic compounds. You have been asked to prepare and test an organic compound as part of your work.
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Task	As a laboratory technician in a pharmaceutical laboratory you are required to prepare and test an organic compound. Your supervisor has also asked you to prepare a report that explains common reactions of organic compounds. Your work will be in three sections: Section 1 is to look at the theory of organic chemical reactions: • Explain the reactions of typical halogenoalkanes (reasons for trend in reactivity of chloro, bromo and iodoalkanes, substitution reactions with water, ammonia and aqueous sodium hydroxide, elimination reactions with sodium hydroxide in ethanol solution) and alcohols (substitution with hydrogen halides, elimination with concentrated sulfuric acid, oxidation with potassium dichromate and dilute sulfuric acid – effect of structure (i.e. primary, secondary and tertiary) upon the extent of oxidation of the O-H group). Include correct names,
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formulae, balanced equations, reaction conditions and products of commercial or biological importance.

- **Review** the reactions of alkanes (reasons for general lack of reactivity (bond energy, polarity), substitution reactions with halogens) and alkenes (reasons for reactivity (bond energy, electron density), addition reactions with halogens, hydrogen halides and hydrogen). Use correct names, formulae of starting materials and products, reaction conditions and balanced equations. **Review** commercially important reactions of hydrocarbons (separation of hydrocarbons from crude oil by fractional distillation, cracking of alkanes, combustion of alkanes and applications, polymerisation of alkenes and applications, hydration of alkenes (e.g. ethene to ethanol) and applications). You should exemplify this with a specified hydrocarbon and following its pathway from fractional distillation of crude oil through to the cracking process and to the products of this process as fuels and as the feedstock for polymers, alcohols and other chemicals. You should provide equations and conditions for all reactions referred to. You should describe the use and importance of the reactions or the products.
- You should use the above reactions to **Construct** at least one correct mechanism for electrophilic addition, nucleophilic substitution, free radical substitution and elimination. Sourced images of mechanisms are **not** acceptable evidence forms for this task. You should supplement these mechanisms with annotation or explanation of the reactive species involved and the bond breaking/bond making that occurs in each step, using scientific terminology correctly and accurately throughout. You should consider the stability of intermediates formed during the mechanism and the formation of different isomers as products.

Section 2 is to make and test an organic compound

- You are asked to choose **one** of the following organic compounds: oxidation of an alcohol (e.g. ethanol) to an aldehydes, ketone or carboxylic acid or dehydration of an alcohol (e.g. cyclohexanol) to alkene or hydration of an alkene (e.g. hex-1-ene) to an alcohol or preparation of a halogenoalkane (e.g. bromoethane, 2-chloro-2-methylpropane) or preparation of aspirin or paracetamol. Your choice should be agreed with your supervisor. You must prepare this compound and depending on the reaction and product you will use some of the following techniques: heating under reflux, distillation, addition of chemicals to purify the product, filtration, and recrystallization. Quantities of reactants and of the isolated product must be recorded so that you can calculate the percentage yield of the organic compound made. You must then test its purity by melting point determination or boiling point determination and check the presence of the correct functional group by chromatography. Draw simple conclusions about the yield, purity and success of the



	preparation. ● Demonstrate good safe working practices and practical skills in the preparation, purification and testing of your compound. Accurately follow given techniques and procedures. Provide the results/notes of practical work, a witness testimony or photographic evidence of working safely and a risk assessment for the preparation and testing of your organic compound. ● Assess different ways to prepare and test the organic product you have made. Assess any factors that may give rise to a low yield or poor purity. Research and propose one other way of preparing the product starting with different reactants, giving a balanced equation, stating the reactions conditions, hazard and risks, equipment needed and where yield and purity may be affected. Section 3 is to separate mixtures using chromatographic techniques. ● You will be given two mixtures to separate by paper chromatography and thin layer chromatography respectively. Before starting your practical work you should explain the main principles of chromatography, its use to separate mixtures and identify compounds. Demonstrate good safe working practices and practical skills when carrying out paper and thin-layer chromatography (TLC) with minimal supervision. Produce chromatograms showing clear separation of spots, repeating the separations if you are not satisfied with the quality of the separation obtained. Comment on the TLC and paper techniques used for separation. Calculate the R_f values and research the literature values for comparison. Analyse the chromatograms by considering factors that affect the quality of separation of the mixture such as the chosen solvent. Comment on the suitability of the chromatography technique for separation of the mixture and consider whether the use of other separation techniques such as distillation and recrystallisation may be more appropriate. You must keep your chromatographs or take photographs of them to demonstrate the quality of separation achieved.
Checklist of evidence required	A detailed report that includes: ● A comparison of the reactions of alkanes and alkenes, including reactions of commercial importance ● A explanation of the reactions of halogenoalkanes and alcohols



	● An explanation of the use chromatography to separate mixtures ● Drawings of mechanisms of organic addition, elimination and substitution reactions ● Preparation and testing of an organic compound ● Analysis of chromatograms and factors that affect the quality of the separation of a mixture ● An assessment of different ways to make an organic compound and the factors affecting the yield and purity
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Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria, you must show that you are able to:
D.D4	Assess different ways to make an organic compound and the factors affecting yield and purity
D.M7	Analyse chromatograms and factors that affect the quality of the separation of the mixture
D.M6	Demonstrate skillful preparation and testing of an organic compound
D.M5	Construct mechanisms for addition, substitution and elimination reactions
D.P9	Explain and use chromatography to separate mixtures
D.P8	Explain the reactions of halogenoalkanes and alcohols
D.P7	Review the chemistry of alkane and alkenes, including reactions of commercial importance
Sources of information to support you with this Assignment	All sources of information suggested are UK based. Centres are free to amend these sources to those available in the Country of delivery where more appropriate. www.edu.rsc.org - organic chemistry www.STEM.org.uk - organic compounds www.chemhume.co.uk - introduction to organic chemistry www.tes.com - organic synthetic pathways



	Within the copyright laws learners could search YouTube for -organic compounds
Notes to the Assessor and technician	The practical activities suggested for this assignment are required to be safety checked by the Centre before use. Pearson Education can take no responsibility for the safety of any practical activities. Before doing any practical activity, you should always carry out your own risk assessment and refer to the necessary regulations. In particular, any local rules issued by your employer must be obeyed, regardless of what is suggested here. Centre should use Health and Safety information provided by a reputable source. In the UK such an example organization is CLEAPSS http://science.cleapss.org.uk/